TOXECON Retrofit for Mercury and Multi-Pollutant Control on Three 90 MW Coal-Fired Boilers

Participant
Wisconsin Electric Power Company

Additional Team Members
ADA-ES—collaborator

Cummins & Barnard—collaborator

Electric Power Research Institute (EPRI)—technology supplier

Environmental Elements Corp.—collaborator

Location
Marquette, Marquette County, Michigan (Wisconsin Electric's Presque Isle Power Plant Unit Nos. 7, 8, and 9)

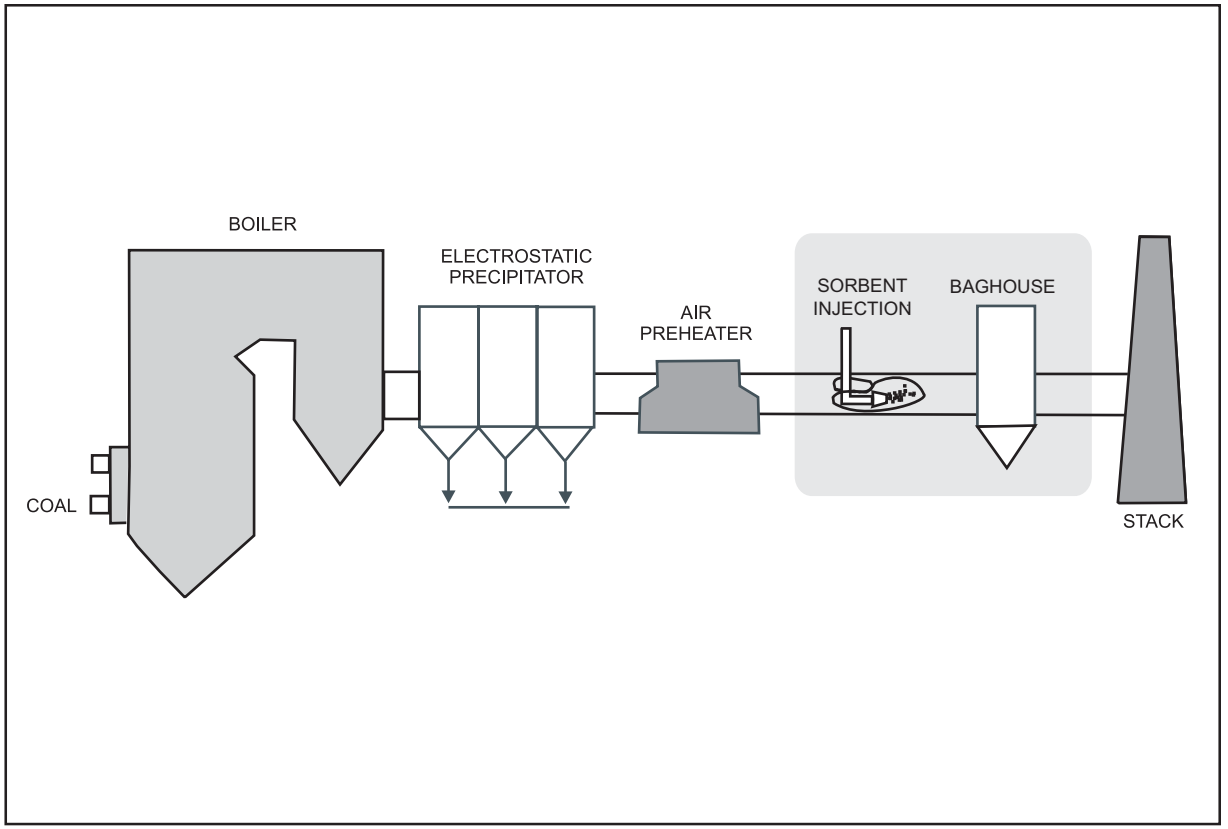
Technology
EPRI's patented TOXECON sorbent injection process

Project Capacity/Production
3 x 90 MW

Coal
Powder River Basin

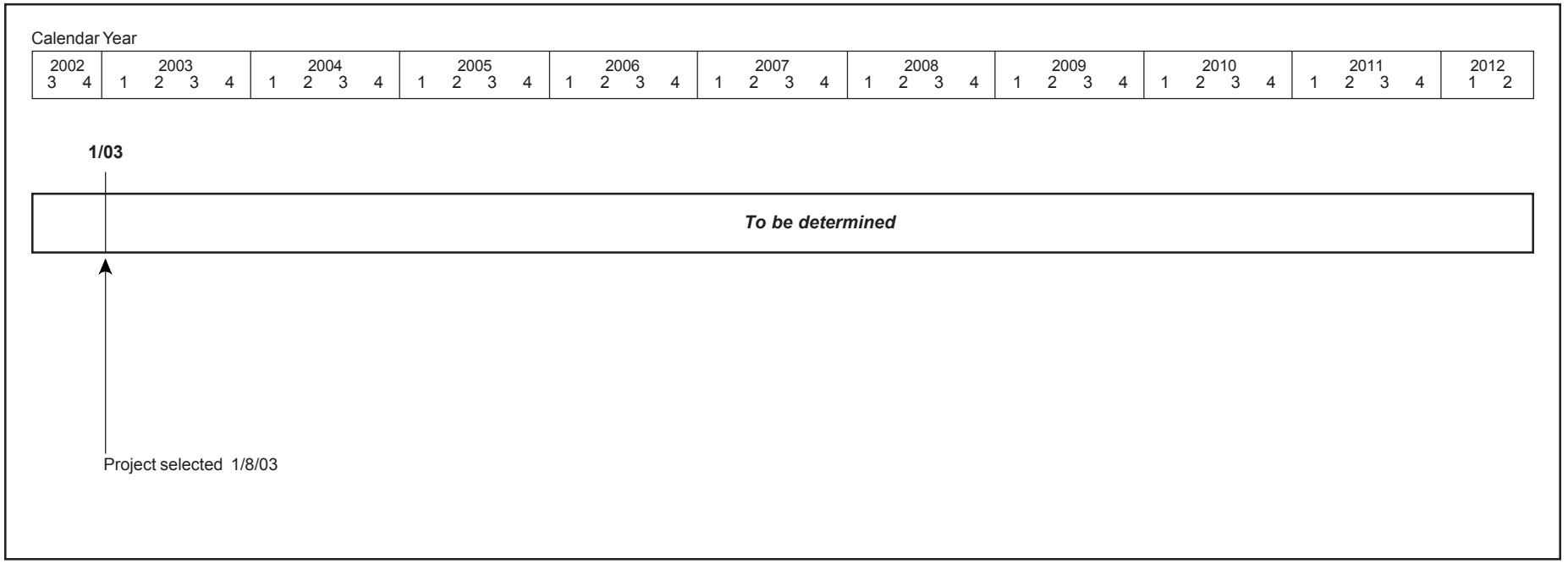
Project Funding

Total	$49,536,624	100%
DOE Share	$24,768,312	50
Participant	$24,768,312	50



Project Objective
To demonstrate EPRI's patented TOXECON process, which injects sorbents into a pulse-jet baghouse installed downstream of the existing particulate matter (PM) control device for mercury (Hg), other air toxics, sulfur dioxide (SO_2), and nitrogen oxides (NO_x) control. Specific objectives are to achieve 90% Hg removal through injection of activated carbon into the flue gas stream, increase PM collection efficiency, determine the viability of sorbent injection for up to 70% SO_2 control and trim control of NO_x, recover 90% of Hg captured in the sorbent, achieve 100% fly ash utilization, advance reliability of Hg continuous emission monitors, and successfully integrate the entire system.

Technology / Project Description
The activated carbon and other sorbents will be delivered into the flue gases between the primary PM control device and the new baghouse. Injection of activated carbon in this manner has distinct advantages over direct injection of activated carbon into an electrostatic precipitator (ESP), which depends on in-flight adsorption of mercury by sorbent particles, whereas in a baghouse both in-flight and fixed-bed capture occur as the flue gas passes through the filter cake on the fabric filter. TOXECON generally has lower carbon injection rates, and has higher capture efficiencies in some cases than direct injection into an ESP. In addition, injection downstream of the primary PM control device does not contaminate fly ash with carbon, allowing for sale and use of the fly ash by-product.



Project Status/Accomplishments

This project was selected for award on January 8, 2003. Negotiations are underway, and a cooperative agreement is expected in mid- to late-2003.

The TOXECON configuration allows for separate treatment, disposal, or sale of ash collected in the primary PM control device. It is expected that when completed in 2008, this technology demonstration project will reduce Hg emissions by 90% and result in capture of about 97 pounds of mercury per year that would otherwise have been emitted to the environment from the three units combined. The multi-pollutant control strategy could be expected to reduce the already low SO_2 and NO_x emissions at the plant by an additional 70% and 30%, respectively, resulting in capture of 4,020 tons per year of SO_2 and 1,470 tons per year of NO_x. In addition, emission of PM would be reduced by 32 tons per year.

Short-term, large-scale testing of activated carbon injection in flue gases has shown that Hg capture results averaged from 87–90% with a carbon injection rate of 1.5 pounds per million cubic feet of flue gas. Additional testing over longer periods is needed to determine the impact of carbon injection on fabric filter bag life, cleaning frequency, and particulate collection efficiency. Powder River Basin (PRB) coal, like that fired at the Presque Isle plant, has a high percentage of elemental, as opposed to oxidized, mercury. Activated carbon is known to capture elemental mercury, the most challenging species of mercury to capture. Other test results have shown that sodium-based products can achieve 30% to 70% reduction in SO_2 emissions, but at normal flue gas temperatures calcium-based products are not effective. Sodium based sorbents have also reduced NO_x by 10% to 20%. A HCl removal efficiency of 50% has been documented with injection of sodium-based sorbents.

Commercial Applications

The technology can be incorporated into systems that currently employ cold-side ESPs, as well as hot-side ESPs as primary PM control devices. Injection of sorbents will take place downstream of the air heater in systems employing hot-side ESPs, such as the Presque Isle Plant, where relatively cool temperatures below 350 °F allow absorption of Hg by activated carbon. TOXECON is one of the few mercury control technologies that can be applied to systems employing a hot-side ESP because temperatures are generally too high in the ESP to allow for absorption upstream or in the ESP.

A primary benefit of this project is its potential as a low-cost option for dramatic, deep cleaning of plant air emissions, especially those of mercury. The project's successful implementation will help provide an approach for segments of the power-generating industry to achieve timely compliance with future mercury regulations.

This technology may prove to be the primary Hg control choice for western coals and the only choice for units burning any coal type with a hot-side ESP. Thus, the TOXECON process has application at unscrubbed power plants burning coals with hot-side ESPs (18 GW), plants burning western, sub-bituminous coals with cold-side ESPs (68 GW), and plants burning bituminous coals with cold-side ESPs (81 GW). Using TOXECON to control SO_2 and NO_x further enhances its attractiveness for improved environmental control.